New ophthalmology course AFCM

Diseases of the Optic nerve and Neurophthalmology

ILOs



- The student should be able to:
- 1. Diagnose afferent system lesions
- 2. diagnose efferent system lesions
- 3. Differentiate clinical presentations in neuro-ophthalmology
- 4. Know the appropriate investigation to choose
- 5. Solve clinical problems related to neuroophthalmology

Introduction

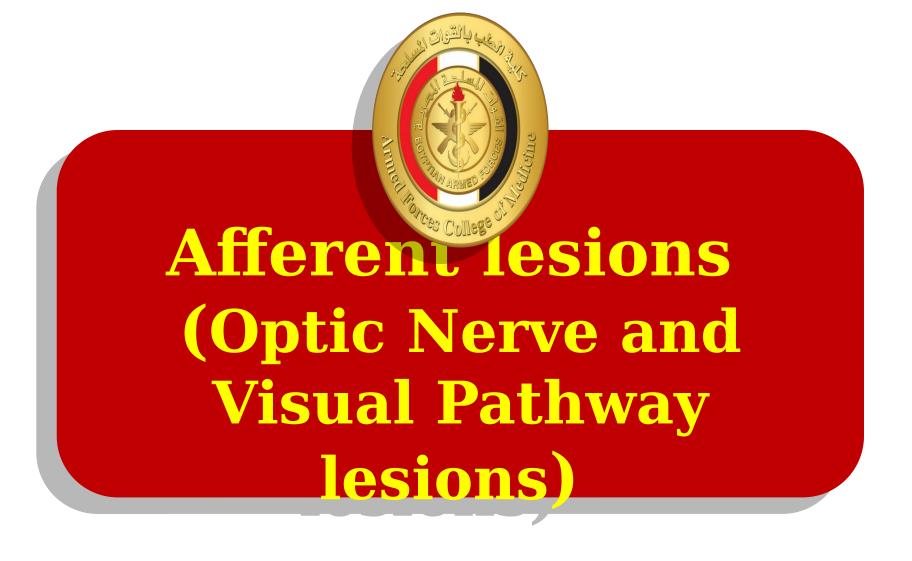


The eye is technically a part of the brain

- Embryologically it develops as an extension from the forebrain
- It has the largest cranial nerve connections (2,3,4,5,6,7)
- The optic nerve is a CNS tract and not a typical cranial nerve (does not regenerate)

Functions of cranial nerves connected to the eye

- **CNII (Optic nerve):** carries vision sense from retina to visual centers in the occipital cortex
- **CNIII (Oculomotor nerve):** supplies all eye-moving muscles except the lateral rectus and the superior oblique, levator muscle and parasympathetic nerve supply to internal eye muscles
- **CNIV** (**Trochlear nerve**): supplies the superior oblique muscle
- **CNV (Trigeminal nerve):** carries somatic sensations from eye, orbit and adnexa)
- CNVI (Abducens nerve): supplies the lateral rectus muscle
- **CNVII (Facial nerve):** supplies the orbicularis oculi muscle and parasympathetic supply through its Chorda tympani division



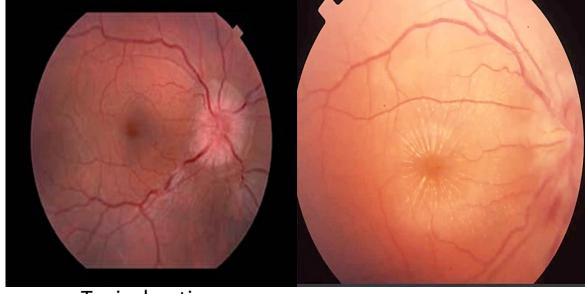
Optic Neuropathy



- Are condition characterized by deterioration of optic nerve function
- Loss of visual acuity
- Loss of color vision
- > Loss of contrast
- Pupil: RAPD (unilateral)
- > Fundus changes
- Visual field changes (scotoma)

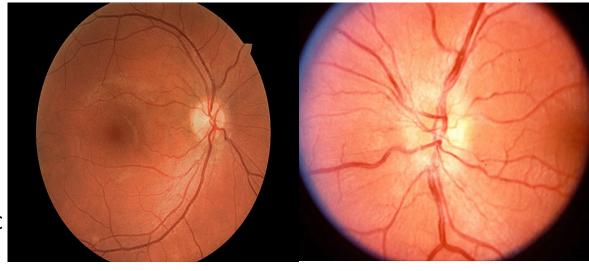
Fundus in ON

- Optic nerve head (optic disc)
 - may be **swollen** in papilledema and papillitis
 - may be **normal** in retrobulbar neuritis
 - May show macular **fan** in neuroretinitis
 - may be **pale** in ischemic optic neuropathy



Typical optic neuropathy

Macular fan Neuroretinitis



Retrobulbar neuritis (normal)

AION (pale)

Demyelinating (typical) (



- Common, Frequently presents to the ophthalmologist
- **Pain** is COMMON (>90%)
- Retrobulbar neuritis is the most common presentation
- Fundus is normal but all other clinical features of ON are present
- MRI with gadolinium contrast shows typical demyelinating plaques in the periventricular and deep white matter in many cases

 MS
- MRI is normal in idiopathic cases

Classic Picture



- Female <u>18-30 years</u> complaining of acute retrobulbar pain associated with drop of vision in one eye
- Fundus is normal
- Pupil shows RAPD
- Color vision affected
- VEP <u>delayed</u>
- Field changes present (non-spender)
- MRI normal or <u>shows MS changes</u>



Treatment



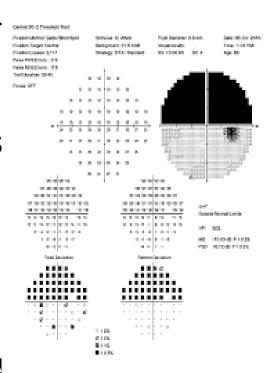
Patients must be rapidly referred for
 INTRAVENOUS steroid therapy which speeds recovery and may decrease severity of subsequent MS(ONTT= optic neuritis treatment trial) IV ORAL

Patient should NOT be treated with oral steroids

Ischemic ON



- Usually affects elderly people <u>above 60</u>
 <u>yrs</u>. with history of hypertension and/or diabetes
- Features of optic neuropathy but disc is usually PALE
- Field defect present; commonly
 ALTITUDINAL
- 2 types; non-arteritic and arteritic (**GC**



Non arteritic AAION



- Male or female <u>50-65 years</u> complains of acute drop of vision in one eye
- History of <u>systemic disease</u>
- Fundus shows disc swelling usually pale, other eye has a CROWDED small disc (disc at risk)

Arteritic AION

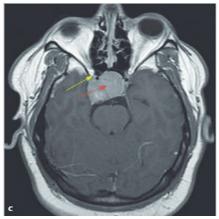


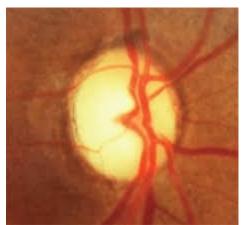
- More <u>above the age of 70 yrs.</u>
- Manifestations of temporal arteritis (GCA) as jaw claudication, temporal headache, polymyalgia rheumatica, tender palpable temporal artery.
- Investigations: Temporal artery biopsy, ESR, CRP
- Medical EMERGENCY: Intravenous steroids are vision saving

Compressive ON

- The optic nerve may be <u>compressed</u> anywhere along its course
- In the orbit by tumors: glioma and meningioma. (Proptosis is common)
- Near the chiasm by <u>pituitary adenoma</u>
- Vision is gradually lost and the optic disc shows pallor and cupping







Investigation of optic neuropath();

Perimetry

Field changes are very helpful in diagnosis of ON

Brain MRI

- Very important in compressive optic neuropathy to exclude <u>brain</u> and <u>pituitary tumors</u>
- Also important in demyelination ON to diagnose or exclude MS

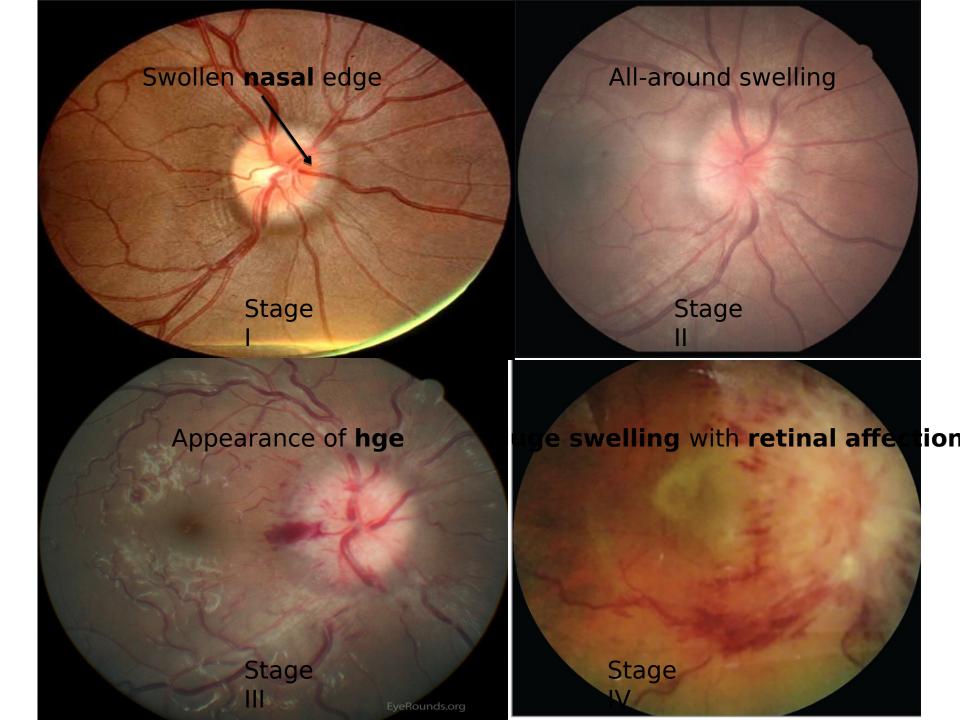
VEP (visual evoked potential)

- Very useful in diagnosing **unilateral** retrobulbar neuritis MRI الـلاول
- Also useful in differentiating <u>neuropathies</u> and <u>papilledema</u>

Papilledema



- Papilledema is a **bilateral** swelling of the optic nerve in the fundus due to <u>increased</u> <u>intracranial tension</u>
- The **high** CSF pressure around the optic nerve causes <u>slowing of axoplasmic flow</u> and <u>increased venous pressure</u>
- Papilledema is generally classified to stages according to the degree of nerve swelling



Papilledema



- The most common cause of papilledema is <u>idiopathic intracranial hypertension</u>
 (IIH)
- The most dangerous cause is brain tumor
- All papilledema warrants a brain MRI
- In early and moderate papilledema,
 vision is normal

Idiopathic Intracranial hypertension (IIH)

- High csf pressure resulting is swelling of both optic nerves (papilledema)
- More in young and middle-aged females
- Predisposing factors include
 - Obesity
 - Hormonal disturbances
 - Contraceptive pills
 - Vitamin A intake

Idiopathic Intracranial hypertensio (IIH)

- Diagnosis is confirmed by
 - A **normal MRI** (subtle changes)
 - Lumbar puncture and measurement of <u>opening CSF</u>
 <u>pressure</u>
- Treatment:
 - Drugs that <u>lower CSF pressure</u> esp. **acetazolamide** and other carbonic anhydrase inhibitors
 - CSF shunts (ventriculo-peritoneal)
 - Optic nerve fenestration surgery

Hemianopia

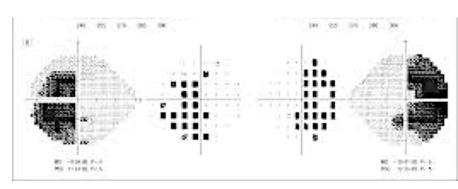


- Is any field defect that respects the <u>vertical</u>
 meridian and does not cross to the other side
- This typical appearance results from decussation of the nasal optic nerve fibers at <u>the chiasm</u>
- So hemianopia is present in <u>chiasmal and</u> <u>suprachiasmal</u> lesions ONLY, it can never happen in optic nerve disease
- ANY hemianopic field defect WARRANTS an MRI

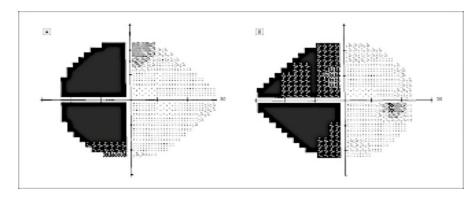
Hemianopia: types



- Bi temporal: chiasma (pituitary)
- Homonymous:
- ➤ Optic tract
- > Temporal radiation
- Parietal radiation
- Occipital: macular sparing



Bitemporal hemianopia

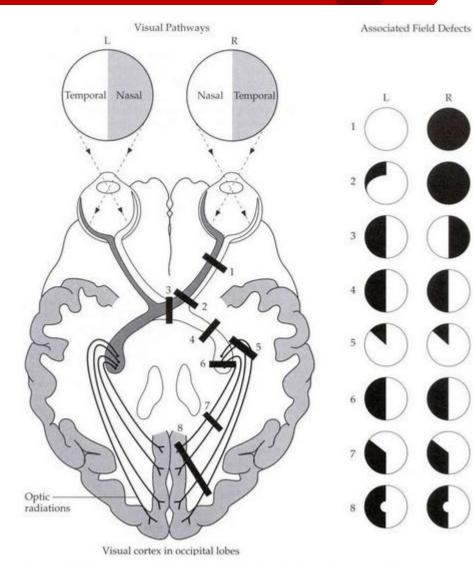


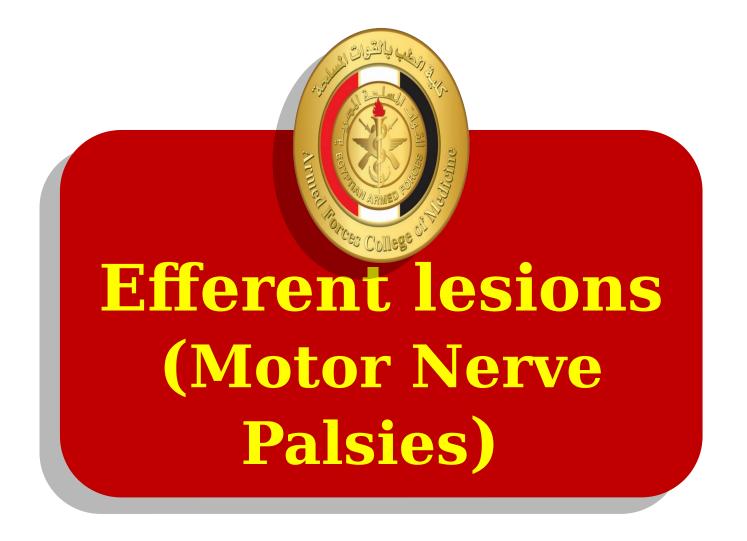
Homonymous hemianopia

Visual pathway lesions

TO COMPANY

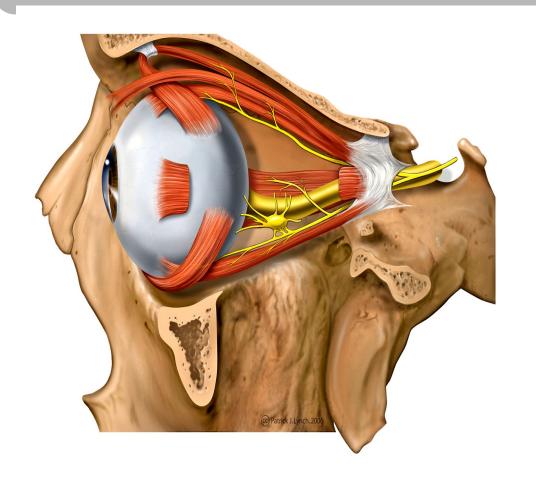
- 1. Mono ocular visual loss
- 2. Junctional scotoma
- 3. Bi temporal hemianopia
- 4. Contralateral homonymous hemianopia
- 5. Contralateral homonymous qudrantanopia (**pie in the sky**) tempora
- 6. Contralateral homonymous hemianopia
- Contralateral homonymous quadrantanopia (pie on the floor) parital
- 8. Contralateral homonymous hemianopia with macular sparing





Third Nerve Oculomotor CN3





Supplies 7 muscles;
ALL
Extra – and Intra –
ocular muscles (ciliary
ganglion)
EXCEPT

SO: Trochlear Nerve (CN4)

LR : Abducens Nerve (

CN6)

Third Nerve Palsy



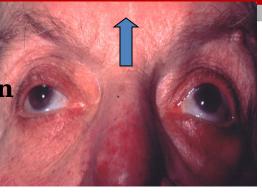
Ptosis, dilated

depressed_globe

Abducted,

pupil

Limited elevation

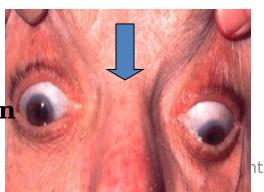


Normal abduction





Limited adduction



Limited depression

6/13/24

Third Nerve Palsy

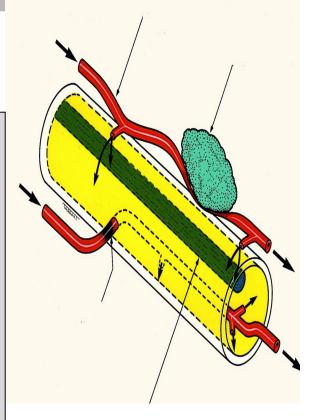


The parasympathetic (pupil constricting) fibers lie superficially in relation to other 3rd nerve fibers, they are more susceptible to compression.

Therefore, the presence or absence of **pupillary dilatation** is very important to differentiate between:

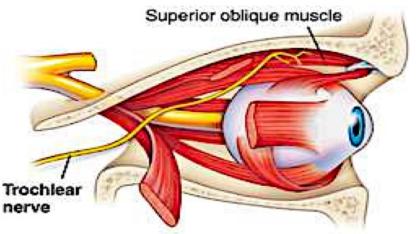
Surgical causes of 3rd nerve palsy where the pupil is involved (e.g. aneurysms)

Medical causes (e.g. diabetic neuropathy) where the pupil is usually spared



Fourth Nerve Palsy







Hypertropia



Vertical Diplopia



Head Tilt to opposite shoulder₂₈

Fourth Nerve Palsy



Causes of 4th nerve

palsy



Congenital



Acquired
Closed Head Injury (<u>Bilateral</u>)
Micro vascular (DM, HTN)
(<u>Unilateral</u>)

Sixth Nerve Palsy



- The abducent nerve is <u>a thin long nerve</u> the passes from the pons to the orbit to supply the **lateral rectus** muscle responsible for abduction of the eye
- The nerve passes over the <u>sharp border of the petrous</u> <u>temporal bone</u> which makes it particularly vulnerable to <u>head trauma</u> and <u>increased intracranial tension</u> (**false localizing sign**)
- The **fundus** should be <u>ALWAYS carefully examined</u> to exclude papilledema
- Causes of Isolated 6th nerve palsy
- in adults: trauma or diabetes
- in children: trauma or viral infections

Sixth Nerve Palsy







Limited abduction (RT)



Horizontal Diplopia





Face Turn to <u>same</u> <u>side</u> (LT)

Fifth Nerve Palsy

- The trigeminal nerve arises from the pons
- It supplies the eye and orbit through its <u>Ophthalmic branch</u> (V1)
- Carries sensations from the eye and orbit through the trigeminal ganglion
- Isolated palsy is seen in Herpes (loss of corneal sensation)
- Loss of corneal sensation could result in <u>persistent corneal</u> <u>ulceration</u> (neurotrophic ulcer).



Testing corneal sensation



Neurotrophic corneal ulce

Seventh Nerve Palsy



- It presents by Lagophthlmos (incomplete closure of palpebral fissure due to paresis of orbicularis muscle)
- The most common cause of LMN CNVII nerve palsy is idiopathic (Bell's palsy), followed by <u>parotid</u> <u>gland diseases.</u>
- UMN facial palsy occurs with <u>hemiplegia</u> and does not affect the upper face (and orbicularis) WHY?

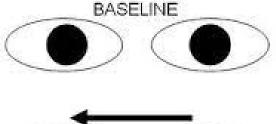
Gaze Palsy

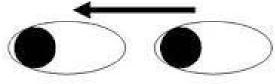
- Inability to move both eyes is a certain direction
- Horizontal
 - ✓ Voluntary: frontal eye-field; moves eyes to the opposite side
 - ✓Involuntary: PPRF in pons; moves eyes to the same side
- Vertical: midbrain; interstitial nucleus of Cajal
- Test for ocular motility: Duction vs version

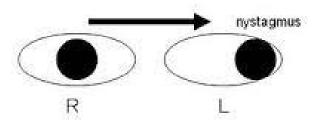
Internuclear ophthalmoplegia



- Lesion of medial longitudinal fasciculus (MLF) that joins eye movement nuclei (3rd and 6th)
- Causes
 - Young MS
 - Old∏ stroke
- Effects
 - Failure of adduction of one
 - Nystagmus of the abducted









Pupil Abnormalities

Pupil size and shape



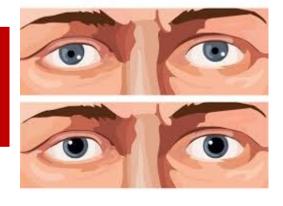
- Normal pupil is 3-4mm in light and increases to 5mm in dim light.
- Anisocoria (Unequal pupils): sometimes physiologic (<1mm difference).
- Heterochromia (different iris color): may be manifestation of <u>congenital</u> <u>Horner syndrome</u>
- Normal pupils are RRR





Miosis vs Mydriasis





Miosis

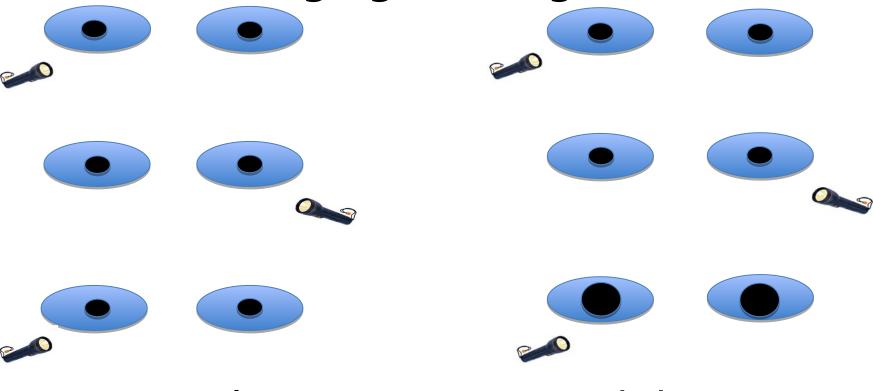
- Senile
- Sleep
- Hypermetropia
- Horner syndrome
- Miotics
- Muscarinic drugs
- Morphine therapy and overdose
- Organophosphorus poisoning and insecticides
- First and 3rd stage of anesthesia
- Pontine hemorrhage

Mydriasis

- Colored iris
- Anger, rage, fear (sympathetic)
- Myopia
- 3rd nerve palsy
- Mydriatics
- Atropine therapy and overdose
- Drugs with atropine-like effects
- 2nd and 4th stage of anesthesia
- Uncal herniation (bilateral 3rd nerve)

Relative Afferent Pupillary Defect (RAPD)

Swinging flash light test



Normal

Right RAPD

Light near dissociation



Respond to near, not light (never

reversed)







Thank you for your attention

